laws of irreversible heat-phenomena from probability considerations becomes more and more difficult the more it is studied. But physicists have given us another source of irreversibility, of which the kinetic theorist has hitherto made little use. The equation

$$\frac{d^2(r\phi)}{dt^2} = a^2\frac{d^2(r\phi)}{dr^2}$$

representing propagation of spherical waves is satisfied mathematically by $r\phi = \mathrm{F}(at+r)+f(at-r)$; but the physicist has to make the axiom that waves always radiate *from*, and never converge *to* a source of disturbance, and hence, that the second term alone exists in nature. Seeing that the molecules on our earth derive so much of their heat-energy from the sun, which energy is (if we may use the expression) transported across some ninety million miles of ether by equations of this type, it is surely desirable that some working hypothesis should be formulated for the conversion of radiant energy into energy of heat motion, and a kinetic theory involving such a hypothesis would explain irreversibility as a natural consequence of the simple axiom involved in the suppression of $\mathrm{F}(at+r)$.

We trust that neither Mr. Burbury nor Prof. Boltzmann will construe any of these remarks into expressions of criticism on the points of difference between their conclusions, and we hope that ere long both these writers will enlighten us further on the questions at issue. The writer of the present review has (doubtless in common with many others) spent a considerable amount of time in trying to attack that tantalising question of temperature from a kinetic standpoint coupled with probability considerations, or even deducing the law of molecular distribution from the temperature-property; but every attempt leads to an impenetrable wall built of dense assemblages of molecules which cannot be assumed to follow the Boltzmann-Maxwell distribution, and which seem to say to the mathematician, "Thus far shalt thou go, but no further."

G. H. BRYAN.

THE ZOOLOGY OF THE INDIAN SEAS.

A Descriptive Catalogue of the Indian Deep-Sea Fishes in the Indian Museum. Pp. iii+212 and viii.

An Account of the Deep-Sea Brachyura. Being Systematic Reports upon the Materials collected by the Royal Indian Marine Survey Ship "Investigator," 1874–1899. By A. Alcock, M.B. Pp. ii+85. (Calcutta: Printed by the Trustees of the Indian Museum, 1899.)

THE Catalogue of Deep-Sea Fishes is a monumental work, since it completes the description in full of a large number of species already listed in the author's papers, now well known, and illustrated in the "Illustrations of the Zoology of the *Investigator*" which he inaugurated in 1892, and which, thanks to the skill of his native artists, is likely to become classic.

The fishes dealt with number 169 species, the Anacanthini and Physostomi being, as might be expected, in the majority, and but two of them Plectognathi. 126 of these stand to the record of the *Investigator* alone, and 43 only appear identical with species found elsewhere; 23 are said to be common to the Indian seas and the Atlantic, and a special feature is the occurrence of a Trachinoid fish (*a Bembrops*) originally found in Japan. Dr. Gunther, as is pointed out, has already familiarised us with the idea of a former open connection between the Mediterranean and Japanese seas; and, discussing this fish and certain related forms, the author dismissing the "comfortable formula" "similarity of conditions," is led to the conclusion that "a considerable part of the fish-fauna of the Oriental region originated from, and to a certain extent is a remnant of, the fauna of the Tertiary Mediterranean of Suess—of a Mediterranean that extended from the present Gulf of Mexico, through the present Mediterranean basin, far into the eastern hemisphere."

The chief novelty of the present work is a chart compiled from Koken's "Vorwelt und ihre Entwickelungsgeschichte" with the object of rendering clear the bearings of the above conclusion. The present coast-lines and those supposed to have existed during the Tertiary period are indicated in dissimilar contours, and the presumed area of the Inland Sea is rendered appropriately clear. In the construction of this chart the author has sought the advice by Mr. T. H. Holland, formerly of the Royal College of Science, London, and that gentleman's splendid work on the Geological Survey of India amply justifies the choice.

The fresh-water fishes (mainly Ostariophyseæ and Cichlidæ) come in for consideration. The occurrence of a Symbranchid species common in Tropical America and Australia, of Cyprinodonts known from Tropical Africa and America, are duly emphasised, while the author's records concerning the Cichlidæ (Chromides) have an especial value now that our knowledge of this remarkable group is being revolutionised by our distinguished English Ichthyologist, Boulenger.

It is praise sufficient to remark that this grand monograph in no way falls short of its predecessors we have so recently reviewed (see NATURE, vol. lx. p. 459), and that it will remain for generations a standard work of reference.

The report on the Brachyura is serial with those on the Madreporaria and Ophiuroidea, and, like the former, is prefaced by an account of the history of the expedition and of its association with the Indian Museum. It completes the work of the expedition on the crabs, and as regarding descriptions of new species it is supplemental to a series of earlier papers by the author, his former associate and predecessor in office, the late Prof. Wood-Mason, and his present colleague, Dr. A. R. L. Anderson, extending over a period of more than twenty years. The present volume deals with 53 species and 38 genera, with two exceptions from depths of over 100 fathoms; and of these 21 genera and 5 species are known from other seas. Interest centres in the discovery of affinities between the fauna of the Indian and Atlantic deep-sea areas, which the author is disposed to interpret as indicative of a former open connection between the two, for which he has already argued in reporting upon the Madreporaria. Bathymetrically one species only (an *Ethusa*) was obtained at a depth exceeding 1000 fathoms, 3 (*Ethusa*, 2 sp. and a *Hypsophrys*) between 800 and 1000 fathoms, 3 between 500 and 800, and 18 between 400 and 500, while of the majority obtained at depths of from 100 to 400 fathoms

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many also occur in shallower water. A supposed *Doclea* stands alone as a true shallow-water species captured at the hundred fathom line.

The list reveals a predominance of Oxystomid and Oxyrhynchid forms, and the careful diagnoses which comprise the bulk of the report are illustrated by four exquisite plates, drawn by the native artists who so fully distinguished themselves in the delineation of the corals. For accuracy and beauty of execution they would be difficult to surpass, and it affords us great pleasure to add that in the collotyping process employed by Messrs. Taylor and Francis, who have reproduced these drawings, nothing has apparently been depreciated or lost. The result is an entirely new departure in English art work, full of promise for the future. In dealing with the higher Crustacea Dr. Alcock is on his strongest ground, for his "Materials for a Carcinological Fauna" is already an established work of cyclopædic importance. The result of the present undertaking is a triumph for those concerned, the *tout ensemble* a memorable one, and as a final comment upon it we can only add that Dr. Alcock has incurred yet another contribution to the debt of gratitude due to him by zoologists at large.

ANTIQUITIES OF CENTRAL AMERICA.

A Glimpse at Guatemala and Some Notes on the Ancient Monuments of Central America. By Anne Carey Maudslay and Alfred Percival Maudslay. With Maps, Plans, Photographs, and other Illustrations. Pp. xvii + 289. (London: Murray, 1899.)

FOR the last two decades the name of Mr. A. P. Maudslay has been the most conspicuous of those associated with archæological work in Central America. No other explorer, not even excepting Mr. Stephens himself, has covered so much ground and obtained such valuable results in this wide field of research. Since 1881 he has spent many years amid the ruined cities of Guatemala, Yucatan, and Honduras, has studied the monuments in minute detail, taken innumerable drawings and castings of carvings and inscriptions, drawn elaborate ground plans of palaces and temples from which the rank vegetable growths had first to be cleared. On the main and special features of these crumbling remains he has published several copious monographs in the *Geographical Journal* and elsewhere, and is now giving to the world the results of his seven expeditions in the *Biologia Centrali-Americana*, of which eight parts, with no less than 200 plates, have already been issued.

When, therefore, this sumptuous volume was announced, specialists and other close students of American antiquities looked forward to a great banquet spread out with a view to their particular tastes and expectations. In this respect they will certainly be somewhat disappointed, while the general public will be all the more charmed with a book of travels which is written in a fascinating style, and in which the note of living human interest is stronger than that of a vanished past. The book is exactly what it professes to be—a brightly written account of a final visit paid in 1894 to the scene of his long and fruitful labours, the main object being to take a general look round, and give in a small compass a rough idea of the vast amount of work which has been accomplished, and will be permanently recorded in the more costly and less accessible volumes of the *Biologia*.

During this last survey Mr. Maudslay was accompanied by his wife; and the arrangement by which the lighter and more descriptive sections were entrusted to her skilful pen has been attended with the happiest results. Besides some very searching "glimpses" at the country, its scenery, vegetable and animal life, and present inhabitants, special visits were paid to Coban, Rabinal, Copan, Quiregua, Ixkun, Chichen Itza, Palenque, and Tikál, and some further archæological work carried out at several of these places. Special chapters written by Mr. Maudslay are devoted to such work, while Mrs. Maudslay takes charge of the incidents of travel, household matters, the surroundings, attitude of the natives, and so forth. Some of her pictures are extremely graphic, as when she enters sympathetically into the bird life, and tells us how

> "we shared our dining room with the birds, who came in flocks to feed on the ficus and other fruit-bearing trees, and we were never weary of watching them at play amongst the branches overhead. At first the parrots and parroquets vastly outnumbered all the others, and appeared to have formed a settlement in the tree above our tent. These parrots were a boisterous family, who woke at dawn, and began screaming and chattering whilst they performed round the branches all those gymnastic feats which I have thought were only devised in captivity to vary the monotony of cage-life. But the parroquets, who lived in the same tree, appeared to be quiet little creatures, who nestled near to one another, whispering and cooing gently, until some sudden impulse would seize both parties, and they would dash off in the air, flashing circles of gold and red and green as the sun caught the glint of their plumage, and then return as suddenly to the shelter of the trees to chatter loudly over their exploits."

While all this is going on, Mr. Maudslay is busy amid the neighbouring ruins on the banks of the Copan, which he had first surveyed in 1881, and studied more carefully in 1885. Here was revealed the fine ornamental doorway of a temple, and here the important discovery was made that nearly all the truncated pyramidal mounds had been crowned by temples, thus bringing these monuments, like those of Chichen Itza, Uxmal, and so many others in Yucatan, in line with Cholula, Teotihuacan, Papantla, and the one or two other extant Mexican *teocalli*. The genesis of all is the same—mounds raised above the remains of departed chiefs, and terminating, not with a point as in Egypt, but with a platform on which to perform sacrificial rites and build the teocalli ("God's House"), when in due course the great chief joined the Clympians. But were these structures built by the same race, and, if so, by whom? In a chapter on "Conclusions" Mr. Maudslay discusses this vexed question in connection with the obscure relations of Toltecs, Nahuas, and Mayas, and infers that the Toltecs were not of Aztec (Nahua) but of Maya stock. He, however, speaks with uncertain voice, and still doubts whether the stream of migration set from Mexico southwards or from Central America northwards. But the problem may now be regarded as solved in favour of the first assumption; and if Mr. Maudslay hesitates, it is only

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